

Bioenergy Research in the Netherlands

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ABSTRACT:

To achieve a sustainable energy supply in the Netherlands a major transition is required in several areas of the domestic economy. Long term energy research will support the transition only when it is focused. A new Energy Research Policy was formulated where clear choices were made. The criteria used are the impact of the technology and the national strength. Bioenergy Research has been chosen as a focal point for long term R&D in the Netherlands. Domestic consults and field studies have elucidated the focal points of the biomass research in the area of biorefinery, power and heat, and gascleaning, and syngas.

1. Energy Research Policy: EOS

A realistic research strategy calls for a focus on a limited number of subjects. This requires choices and a new basis for financial allocations. As private sector research is concentrating increasingly on the short term, the government is shifting its focus to the long term.

Choices must be made in order to maintain high quality of research. This quality is increasingly assessed in an international context. After all, the Netherlands maintains close relations with the outside world. From the point of view of efficiency, this position means that the Netherlands should 'do what it is good at'. Dutch research networks should conduct more of their work in an international context. The main selection criterion is the (potential) contribution of the research to a sustainable energy supply that ensures security of supply. The second criterion is whether the Netherlands has a leading position in the field of energy research in question.

Focus is on subjects where the (potential) contribution is high and where there is a leading position ("focus areas"). Import of knowledge is justified when the potential is high, but where there is presently no leading position for the Dutch technology network ("import themes"). Energy research policy will from now on restrict itself to the focus areas and the import themes.

This new energy research policy¹ was adopted by Parliament in 2002. Since then a market consultation was carried out to identify the needs and strengths in the Dutch society. A further scouting was carried out by Senter and Novem to define the research areas in more detail which resulted in 5 Energy Research Priority areas. In 2003 a Programme Formulation

Team was established for each area and in April 2004 the Programmes completed.

EOS objectives

- Improve efficiency and effectiveness of publicly financed long term energy R&D in the Netherlands.
- Ensure continuity of long term energy R&D into sustainable, efficient and secure supply of energy whilst the sector is transformed by liberalisation and internationalisation.
- Support the Transition to Sustainable Energy supply
- Support the Dutch technology position within international, cooperative networks

The following 5 energy research domains have been identified and after further study and discussion evolved into **research programmes**:

- Energy Efficiency in Industry and Agriculture
- New gas / Clean Fossil
- **Biomass**
- Built Environment
- Energy Infrastructure and Offshore wind

The first tender for proposals is expected at the end of 2004. The total annual budget will be around €35 Million for all the five areas.

It is important to notice that biomass has become one of 5 priority domains in the energy research programming in the Netherlands

¹ Download the Executive Summary of the EOS Energy Research Strategy from:
<http://www.ez.nl/publicaties/pdfs/02ME04.pdf>

2. Biomass Research Program

Within the field of Biomass a field study and consultations of the market and research institutes have resulted in formulation of the following biomass research areas:

1. Biorefinery
2. Electricity and heat from biomass, incl. co-firing and co-feeding
3. Gasification and gas cleaning/ preparation
4. additional: Feed preparation

2.1. BioRefinery

The biorefinery concept has been identified as a priority area and can be seen as an overall concept to utilise biomass efficiently for energy as well as other applications like chemicals.

The goal for the biorefinery area is defined as:

Goal: Efficient conversion of biomass in high value components for application in the energy and chemical sector.

The following subareas will be developed within this part of the EOS Biomass program:

- Development of biorefining concepts; chain analysis
- Primary biorefining
- Secondary refining
 - (bio) chemical routes
 - Thermo-chemical routes
- Application of biofuels in the transport sector

Primary refining refers to the preparation of the original source to intermediates. This could be a pyrolysis or hydrolysis process. Secondary refining refers to the production of the end-product which can be sold to the end-user.

2.2 Electricity and Heat

The application of biomass for production of power and heat was not a priority area from the market survey. However building on Dutch experience in implementation in co-firing and co-feeding it became clear that this focus area can contribute substantially to the use of biomass for energy.

The goal of this area is defined as:

Goal: CO₂ neutral power generation

The research to be carried out will embed knowledge import themes concerning feed

preparation and link to the other research areas described under 2.1 and 2.3

For electricity and heat the following specific subareas have been identified:

- Technology to be improved; new technology to be developed (see 2.3)
- Improving performance of biomass/ coal fired power stations: high efficiency to power, adding a sustainable feed component, CO₂ recovery, (Link to "clean fossil")
- Opportunity in the Netherlands:
 - Buggenum, co-feeding in 250 MWe coal gasification power plant
 - Co-firing in gasfired STEG's

2.3 Biomass Gasification and Gascleaning

As mentioned above, the gasification, gascleaning and syngas production is considered as focus area for research in the Netherlands.

For the gasification and gascleaning area the following goal has been defined:

Goal: High efficiency gas production from biomass

In order to achieve the required result one has to consider the integrated chain from biomass to the final application and develop and optimise the entire chain:

Biomass feed, feed preparation (pellets, pyrolysis crude), air or oxygen gasification, gas cleaning, gas preparation, final product manufacture, emissions and by-product handling.

This generic chain will require a wide range of intermediate product gas qualities, depending on application. Considered are

- electricity/ heat
- methanol, Fischer-Tropsch diesel, chemicals
- SNG, H₂

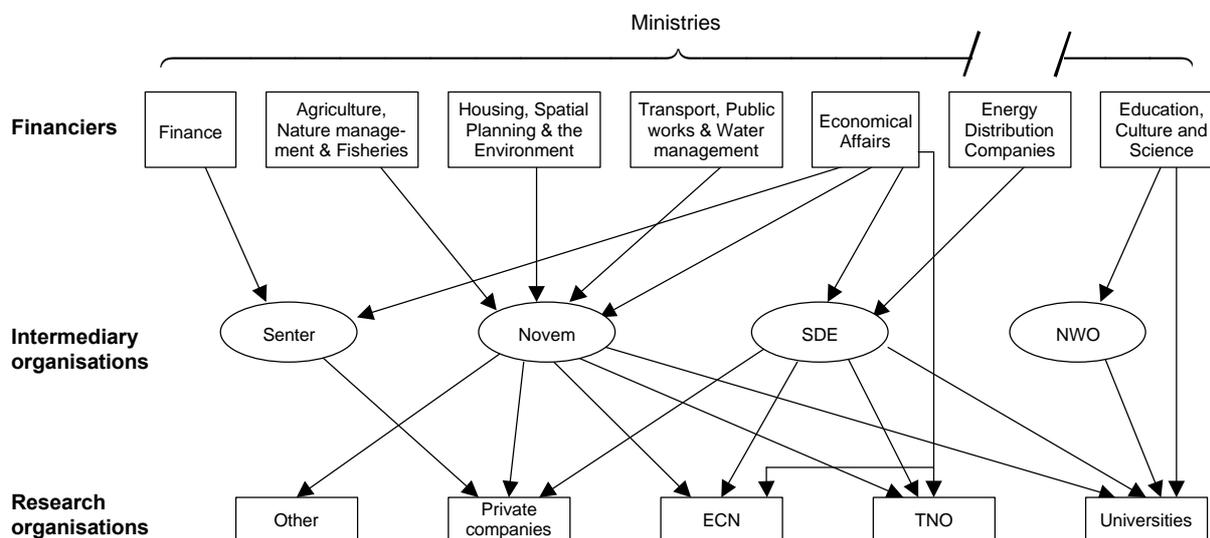
This focus area also puts emphasis on minimisation of environmental impact through by-products and emissions.

3. Conclusion

The Netherlands has a very good infrastructure for integrated R&D on bioenergy although industrial embedding is a problem. Focus for long term Energy R&D has been defined in those areas that are considered crucial for sustainable energy supply; a key element is the explicit integration of cooperation with other international programs.

Annex 1: Biomass Research and Development in the Netherlands

The structure of energy RTD organisation is scheduled in the next figure. In this figure, only larger (> 1 million Euro) financing routes are displayed by arrows.



R&D support comes from the Government by at least 6 different Ministries. The Ministry of Economical Affairs plays a central role in financing national energy R&D. The major part of the financing is performed by intermediary organisations, of which Senter (an agency of the Ministry of Economical Affairs), Novem (Netherlands Organisation for Energy and the Environment and also an Agency of the Ministry of Economical Affairs), SDE (Agency for Renewable Energy research) and NWO (Dutch Scientific Research Organisation) are the most important. Research is performed at universities, research institutions like ECN and TNO, private companies and in some cases also non-profit organisations and private persons.

The annual budget spent by the government every year for research and development of renewable energy conversion techniques and various demonstration projects has grown from €32 million in 1996 to €46 million in 2000. For bio-energy R&D, in 2000 a budget of 14,5 million Euro was available. [numbers from report "publiek gefinancierd energieonderzoek in Nederland. Samenvatting 1995 – 1999, prognose 2000"]. An additional budget of €340 million for CO₂ reduction was made available in 1997. Renewable Energy market introduction projects are financed in this scheme. An additional €36 million for the promotion of sustainable energy was made available in 1998 as a consequence of the Kyoto Treaty for research and demonstration of solar photovoltaics and bioenergy.

In particular research institutes and industry have been able to generate the knowledge required to speed up development

of advanced (co)combustion, gasification, pyrolysis, bio-ethanol production and energy crops. The research institutes, ECN, KEMA and TNO and the agricultural research institute DLO started co-operative work to achieve an optimal industry support. Industry in the Netherlands is small and seeks acceleration through joint ventures with foreign companies.

ECN and TNO get a direct fund from the Ministry of Economic Affairs to perform basic and long-term research. Basic research is further performed at the Universities, of which the three Technical Universities in Delft, Eindhoven and Twente perform a major part. The funding for this research comes traditionally from the Government via the Dutch research council NWO, in which the Technology Foundation STW grant applications to science and technology.

The four intermediates in the field of Energy related R&D&D are the following (the R&D institutes are mentioned in the questionnaire "R&D institutes": Novem is the most important intermediary agency for implementing research, development and demonstration policy. Novem runs programmes in the fields of sustainable construction, living and working, sustainable energy (CO₂ reduction, new fuels, heat pumps, waste and biomass, energy storage in aquifers, solar energy and wind), sustainable processes (energy efficiency and environment) and mobility. Novem is also a funding organisation for research projects, studies, demonstration projects and implementation projects.

Dissemination of knowledge is also an important part of the Novem programme.

Senter is an intermediary agency for the Ministry of Economic Affairs. Its programme focuses on industry. In relation to energy, it finances research and demonstration projects, mostly in the field of efficiency. Senter plays a role as information provider for Dutch industry.

Senter and Novem will merge in 2004 to 1 organisation

NWO is the intermediary organisation that funds university research. Because this research is mostly basic, the exact amount of energy-related research is not clear. Universities perform a large part of Dutch energy research. Funding of this research comes from the Ministry of Education, Culture and Sciences, through NWO.

SDE is a consortium of several universities, knowledge institutes, energy companies and industry. In 1999, SDE started several research projects, concentrating on biomass and system integration. The government is helping finance SDE till 2005.

Research programmes

1. New Energy Research (NEO) (2002 -..., 0.14 M€ for biomass)

The program NEO stimulates new, non-conventional energy research. NEO is intended to enlarge the wealth of ideas in the energy research field and to enable - with advice and subsidies - good ideas to mature. The energy research must be aimed at clean, reliable and affordable energy systems.

NEO is specifically aimed at the ideas that bring forth a technological breakthrough in current energy systems. The technologies have to be applied in the Netherlands and have to be pioneering and about 140 k€ was spent on biomass.

2. Sustainable Energy in the Netherlands (DEN) (2001 - 2004, 3 M€/year spent on biomass R&D&D)

The programme Sustainable Energy in the Netherlands stimulates the application of sustainable energy by supporting initiatives from the market.

Renewable energy options are wind energy, photo-voltaic solar energy, thermal solar energy, passive solar energy, energy from biomass and energy from organic waste.

The goal is to (1) stimulate innovation aimed at application of renewable energy technologies; (2) improve the ratio of price over performance of renewable energy technologies; and (3) take away bottlenecks for the application of renewable energy technologies.

The results of the projects have to be of significant importance for the Dutch energy supply.

The Predecessor of DEN was EWAB, After 2004 this program will be replaced by the EOS Long Term biomass research program.

In 6 tenders a total budget of about 9 Million Euro was made available for 60 R&D projects in area of bioenergy. About 1/3 of the budget was in the area of gasification, 1/4 in the pretreatment of biomass, and 1/4 in reduction of slagging and fouling and emission reduction

3. SDE (1999 - 2004, 4 M€ for biomass R&D)

(“Samenwerkingsverband Duurzame Energie” or “Agency for Renewable Energy Research”) is an innovative research cluster in which the industry and the knowledge infrastructure (universities and research institutes) co-operate and network. The purpose of SDE is to initiate, to facilitate and to co-ordinate relevant research aimed at a more sustainable energy supply.

The industrial partners in the consortium are representatives of the energy production and -distribution or are otherwise engaged in energy conversion.

The research is aimed at the conversion of biomass to gaseous and liquid energy carriers and at system integration (integration of energy systems in energy infrastructures). Research is industrial and aimed at pre-competing development. The research bridges fundamental research and pre-competing development that is closer to the market.

4. Economy Ecology Technology (EET) (1996 - 2003, about 3 M€/year for biomass R&D)

EET gives supports to sustainable technological developments over several years and to one-year projects that prepare such developments. Research in this programme is fundamental with clear economical applications. Projects have to be aimed at:

- Promotion of sustainable economical growth
- Substantial environmental improvements of concrete products and processes
- The better tuning of development of fundamental and industrial knowledge with the application in the market
- The strengthening of the market- and knowledge position of participating companies and knowledge institutions.

There are 3 large projects being supported in the area of biomass utilisation, with a total budget of about 7 million € The project on biological production of hydrogen concluded in 2003 and the other projects on bioethanol production and micro algae will terminate in 2006.

www.eet.nl

In 2004 the EET programme is replaced by the Cooperation Finance Programme, managed by Senter, with a budget of XX million to support R&D, and where sustainability is one of the selection criteria.

Reference: website from the Ministry of Economic Affairs with information about EOS and Energy Research www.energieonderzoek.nl